D. L. A.—F. B. S.

Issued February 17, 1916.

United States Department of Agriculture,

BUREAU OF PLANT INDUSTRY,

Office of Dry-Land Agriculture,

WASHINGTON, D. C.

COOPERATIVE SHELTER-BELT PLANTING ON THE NORTHERN GREAT PLAINS.

INTRODUCTION.

The agricultural appropriation act for 1913 provided for the establishment of an experimental field station on the northern Great Plains for the demonstration of the kind and character of trees, shrubs, and other plants best adapted to the climate and soil of the semiarid lands of the United States. This station was located at Mandan, N. Dak. In the development of one line of its work the station is undertaking to cooperate with a number of farmers in the northern Great Plains area, showing the feasibility of planting shelter belts on these farms. The object of this work is to stimulate interest in the planting of shelter belts and in this way to assist the farmer in improving the home surroundings.

Under the restrictions outlined in this circular the Department of Agriculture will furnish the tree and plant material necessary for planting a demonstration shelter belt without charge, except that the cooperator will be required to pay express charges on the trees from Mandan, N. Dak., to furnish all labor required in preparing the ground, planting, and cultivating the trees, and to provide necessary protection against injury from live stock or fire.

Farmers wishing to cooperate in the planting of shelter belts should make application on the form provided for this purpose, a copy of which accompanies this circular. Another copy may be obtained by addressing the Northern Great Plains Field Station, Mandan, N. Dak.

Before filling out an application blank the contents of this circular should be carefully read, to avoid all possibility of misunderstanding the conditions under which a cooperative shelter-belt planting is made.

TERRITORY COVERED.

The territory covered by this work is that part of North Dakota and South Dakota lying west of the one hundredth meridian and of

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Montana and Wyoming which lies east of the 5,000-foot elevation. This will be understood to include the following counties: In North Dakota—Bottineau, McHenry, Sheridan, Burleigh, Emmons, and all counties west; in South Dakota—Campbell, Walworth, Potter, Sully, Hughes, Lyman, Tripp, and all counties west; in Montana—Teton, Lewis and Clark, Meagher, Park, and all counties east; in Wyoming—Sheridan, Johnson, Natrona, Carbon, and all counties east.

WHO MAY COOPERATE.

(1) Any person owning or homesteading a farm operated under dry-land conditions within the area above described is entitled to make application for a cooperative shelter-belt planting, provided such owner resides on such farm.

(2) Any public school, either in town or in the country, may apply for a shelter-belt planting, provided that such schools have sufficient land of suitable type.

Applications for schools should be signed by a member of the school board, who will be responsible for the planting and care of the trees.

No trees will be furnished for planting on land that is irrigated or likely to be irrigated, as this work is limited to the growing of trees under dry-land conditions.

No trees will be furnished for planting on town or village lots.

LOCATION AND SIZE OF SHELTER BELTS.

It is highly important that the shelter belt be properly located with reference to the principal yards and buildings. In no case should the trees be closer than 100 feet to the house or barn. An exception to this rule will be made where roads, boundary lines, or the lay of the land will not allow so much space. Where the shelter belt is closer than 100 feet there will always be danger of snow drifting against the buildings or in the dooryards. The trees may be planted as far back as 200 or even 300 feet and still be close enough to afford shelter.

The shelter belt should be laid out so as to afford protection from the prevailing winter winds. Usually, it should be made up of two strips in the shape of a right angle on the north and west (or south and west). In some cases it may be advisable to plant on three sides, but it is not desirable to entirely inclose the farmstead with trees.

The shelter belt should be laid out in a strip of uniform width. Irregular pieces do not make satisfactory plantations.

Inasmuch as a wide belt is more effective than a narrow one, a strip 40 to 100 feet in width and ordinarily 300 to 500 feet in length on each side should be laid out.

On account of the time and labor involved in planting trees, it is not considered advisable to plant more than an acre of ground at one time. The size of the planting will vary from half an acre to 2 acres, and where the total area exceeds 1 acre only half of the ground should be prepared for planting the first year.

A shelter belt on the north and west of the farmstead 80 feet wide and 400 feet long on each side contains about $1\frac{1}{2}$ acres. Trees for only one side of a shelter belt of this size will be furnished to cooperators in one year.

INSPECTION.

During the summer, before the trees are to be set out, the Department of Agriculture will send an inspector to visit the farm on which the proposed plantation is to be made, for the purpose of seeing that the farmer clearly understands the plan to be followed. The inspector will determine whether the shelter belt has been well located and is of correct shape and size and whether the ground has been properly prepared for planting. If in his opinion the conditions are favorable, he will make a drawing showing the location, shape, and size of the proposed planting. From the inspector's map a detailed plan will be made, showing the number of rows, the kind of trees to be planted in each row, and the spacing distance. A copy of this plan will be sent to the farmer. The kinds of trees and the number to be furnished will be in accordance with this plan.

If the inspector finds the conditions unfavorable for planting the following season, he will tell the farmer what necessary preparation should be made and either postpone the application to some future date or cancel it, as the applicant may elect.

In exceptional cases where it will not be possible for an inspector to visit the applicant, the necessary information will be secured by mail.

The following points may make it necessary to postpone or to cancel an application:

(1) If the preparation of the land does not meet the requirements outlined in this circular.

(2) If the shelter belt is not located so as to give protection from the prevailing winter winds to the yards or buildings.

(3) If the land prepared is not of sufficient length or width to make a suitable planting.

(4) If the location is obviously unsuitable for the growth of trees.

(5) If the location is closer than 100 feet to the house or barn.

KINDS OF TREES.

The principal trees used are box elder, ash, elm, poplar, and willow. Other kinds of known hardiness may be used in certain plantations. The kinds selected for a shelter belt will be those believed to be best adapted to the local conditions of soil and moisture.

For the work described in this circular no fruit trees, evergreens, or ornamentals will be supplied.

SIZE OF TREES.

The stock used will in most cases be as follows:

Box elder, 1-year-old seedlings, 6 to 18 inches in height.
Green ash, 2-year-old seedlings, 8 to 18 inches.
Poplars and willows, either unrooted cuttings or 1-year-old rooted cuttings; the latter will range from 2 to 4 feet, but will be cut back to about 8 inches. Unrooted cuttings will be furnished only when the available rooted stock is insufficient.
Elms and other trees, 1 or 2 year old seedlings, 8 to 24 inches.

In exceptionally dry years the trees will be smaller than in normal years.

Small trees are used exclusively, as they are most certain to grow when transplanted. If a tree is allowed to become too large before it is dug it is impossible to get all of the roots. When such a tree is transplanted, unless the branches are cut back, the demand of the large top for moisture is often far in excess of that which the remaining roots are able to supply. This condition results in very slow growth the first year and often in the death of the tree. With a small tree, however, practically the entire root system can be taken up. Other advantages of using small trees are the saving of labor in planting and the reduction of express charges.

PREPARATION OF THE LAND.

It is not the desire of the Department of Agriculture to add to the burden of the cooperator by insisting upon any rules except such as it is believed will contribute to his chances of success. Under dry-farming conditions trees have a fair chance of growth only when they are planted in moist soil, free from sod and grass, and then kept free from all vegetation except the trees.

It is believed that this condition will be best obtained by observance of the following requirements. It is further believed that any farmer who complies with these requirements will evidence sufficient interest in the work to warrant the Department of Agriculture in undertaking cooperation with him:

(1) All land must be clean summer-fallowed the year before the trees are to be planted. This will insure a seed bed as moist as could be obtained by any method; it will free the soil of coarse material, such as stubble and weeds, which may prevent the soil packing firmly about the tree roots, and by cleaning the soil of weeds will to some extent reduce the labor of cultivation after the trees are planted.

(2) All land must have been broken from sod at least two years before the trees are planted. Under average conditions this length of time is necessary to work the sod down in good condition for trees and to kill out the native grasses, so they will not resod the land and interfere with cultivation after the trees are planted.

(3) All land should be plowed to a good depth. This makes it easier to set the trees to the proper depth and insures the work being better done.

(4) Where soils are so sandy that summer tillage is impracticable, the above requirements will not be insisted upon. Specific instructions for preparing such soils will be furnished upon request.

SPACING DISTANCES.

As these plantings are in relatively long and narrow belts for the purpose of windbreaks and shelters, comparatively close spacing will be the rule. The trees will usually be set 4 by 8 feet. Close spacing makes clean cultivation more certain and at the same time shortens the period of cultivation. Under dry-land conditions the great danger to a plantation of trees is in the intrusion of grass and weeds, and the sooner the trees grow together and shade the ground the sooner this danger is passed.

Close planting forces the growth upward, so that the height of the shelter belt usually increases more rapidly than when the trees are spaced farther apart.

CULTIVATION OF TREES.

After the trees are planted they must be kept well cultivated and free from weeds until they have grown large enough to shade the ground completely. It is only after complete shade is established that cultivation should be discontinued. Grass and weeds are the worst enemies of young trees, and if once well started will invariably stunt their growth and eventually destroy the plantation. Inasmuch as certain grasses when once started are very hard to kill by surface cultivation, the only safe method to follow is to keep the ground clean at all times. To insure proper cultivation the farmer should own or have the use of a 1-horse cultivator.

HOW TO MAKE APPLICATION.

If, after carefully reading this circular, a farmer wishes to make a cooperative shelter-belt planting, he should first determine whether or not his farm lies within the territory to which the work is limited, as described in the first part of this circular. He should then carefully fill in all the spaces on the application form, a copy of which is inclosed, and mail it to the Northern Great Plains Field Station, Mandan, N. Dak. An additional copy of the application blank will be supplied, if requested.

Applications must be sent in before April 1 of the year previous to the time the plantings are to be made. For example, an application for trees to be sent out in the spring of 1917 must be received on or before April 1, 1916. If the application is received after that date the trees can not be furnished until 1918.

As the quantity of stock which will be produced is limited it will be necessary in case the applications of any one year exceed the quantity of stock available to limit the number of cooperators accepted in any one locality or the quantity of stock furnished for any cooperative planting.

Approved:

WM. A. TAYLOR,
Chief of Bureau.

DECEMBER 18, 1915.

PUBLICATIONS OF THE U. S. DEPARTMENT OF AGRICULTURE RELATING TO FOREST MANAGEMENT.

AVAILABLE FOR FREE DISTRIBUTION.

White Pine under Forest Management. (Department Bulletin 13.)
Utilization and Management of Lodgepole Pine in the Rocky Mountains. (Department Bulletin 234.)
The Northern Hardwood Forest: Its Composition, Growth, and Management. (Department Bulletin 285.)
Shortleaf Pine: Its Economic Importance and Forest Management. (Department Bulletin 308.)
Boxelder, Acer negundo. (Forestry Circular 86.)
Osage Orange, Toxylon pomiferum. (Forestry Circular 90.)
Green Ash, Fraxinus lanceolata. (Forestry Circular 92.)

FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS.

Hardy Catalpa: 1. Hardy Catalpa in Commercial Plantations. 2. Diseases of Hardy Catalpa. (Forestry Bulletin 37.) Price, 40 cents.
Windbreaks: Their Influence and Value. (Forestry Bulletin 86.) Price, 30 cents.
How to Cultivate and Care for Forest Plantations on Semiarid Plains. (Forestry Circular 54.) Price, 5 cents.
How to Transplant Forest Trees. (Forestry Circular 61.) Price, 5 cents.
Norway Spruce, Picea excelsa. (Forestry Circular 65.) Price, 5 cents.
White Elm, Ulmus americana. (Forestry Circular 66.) Price, 5 cents.
Scotch Pine, Pinus sylvestris. (Forestry Circular 68.) Price, 5 cents.
Cottonwood, Populus deltoides. (Forestry Circular 77.) Price, 5 cents.
White Willow, Salix alba. (Forestry Circular 87.) Price, 5 cents.
Black Walnut, Juglans nigra. (Forestry Circular 88.) Price, 5 cents.
Yellow Poplar, Liriodendron tulipifera. (Forestry Circular 93.) Price, 5 cents.
Shortleaf Pine, Pinus taeda. (Forestry Circular 183.) Price, 5 cents.

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D. L. A.—1, revised. Issued June 2, 1924.

United States Department of Agriculture

BUREAU OF PLANT INDUSTRY

Office of Dry-Land Agriculture Investigations

WASHINGTON, D. C.

COOPERATIVE SHELTER-BELT DEMONSTRATIONS ON THE NORTHERN GREAT PLAINS.

INTRODUCTION.

The Northern Great Plains Field Station of the United States Department of Agriculture, located at Mandan, N. Dak., has been conducting experiments in planting trees for shelter belts or windbreaks on the farms of the dry-land areas of the States of North Dakota, South Dakota, Montana, and Wyoming since 1914.

In order to stimulate interest in tree planting and in this way assist farmers in improving the home surroundings, a project has been established through which the department is prepared to cooperate with a limited number of farmers each year in the setting out of actual tree plantings on their farms.

COOPERATIVE SHELTER-BELT DEMONSTRATIONS.

Under the conditions outlined in this circular the Department of Agriculture will furnish without charge the trees necessary for planting a demonstration shelter belt for the protection of farm buildings, barnyards, gardens, or orchard sites. The farmer or cooperator for his part must pay the express or parcel-post charges for shipping the trees from Mandan, N. Dak., and must supply all labor and material necessary for preparing the ground, planting, and cultivating the trees in accordance with instructions and planting plans furnished by the Department of Agriculture. He must also provide reasonable protection against injury to the trees by livestock and fire.

The primary objects of these plantings are to demonstrate the kinds of trees that investigations have shown best adapted to the prevailing climatic conditions, the best preparation of the land, and the subsequent care and cultivation the trees must receive to have a fair chance for successful growth. The number of plantings ordinarily will not exceed one or two in a township or neighborhood.

The number of plantings that will be made in any one year is limited to five in each county. In cases where more than five farmers in a county desire to cooperate in this work in the same year, preference will be given to farms located in neighborhoods where few or no shelter belts are growing.

These demonstration plantings will also be limited in size in accordance with the special conditions existing on each farm. The Department of Agriculture is not prepared to furnish more than 1,000 trees to an individual cooperator.

Where shelter belts of a size requiring more than 1,000 trees are laid out, the trees furnished for the demonstration will be used for one section of the planting only, and arrangements should be made to procure any additional trees needed from some other source. A thousand trees will plant a piece of ground 100 feet wide and 600 feet long. In the case of a proposed shelter belt consisting of two strips of equal size, one on the north and the other on the west of a building site and requiring a total of 1,500 trees, the demonstra-

tion will be made on one of the two strips and 750 trees supplied. Additional trees for future planting ordinarily will not be furnished, except such trees as are needed to replace any of those in the original demonstration at the end of the first season. Demonstrations must be completed in one planting operation, and the fact that a cooperator is furnished less than 1,000 trees will not entitle him to apply for the remainder at some later time. The experience gained in handling the demonstration planting is intended to assist the farmer in selecting trees which he may desire to purchase in the future to increase the size of his own plantings and to enable him to show his neighbors the proper methods to follow in establishing shelter belts on their farms.

HOW TO MAKE APPLICATION.

Those who wish to apply for one of these cooperative shelter-belt demonstrations should make application on the form provided for this purpose. Copies of this form can be obtained by application to the county agricultural agent for the county in which the applicant's farm is located, or in counties where no agricultural agent is employed by addressing the Northern Great Plains Field Station, Mandan, N. Dak. Applications must be made a year in advance of the time of planting the trees.

TERRITORY COVERED.

Shelter-belt demonstrations are limited to farms operated principally under dry-land conditions that are situated within the western half of North Dakota and South Dakota and the parts of Montana and Wyoming lying east of the Rocky Mountains. This area includes the following counties: In North Dakota—Rolette, Pierce, Wells, Kidder, Emmons, and all counties west; in South Dakota—Campbell, Walworth, Potter, Sully, Hughes, Lyman, Tripp, and all counties west; in Montana—Glacier, Pondera, Teton, Lewis and Clark, Jefferson, Madison, and all counties east; and in Wyoming—Park, Hot Springs, Natrona, Carbon, and all counties east.

WHO MAY COOPERATE.

(1) Any person owning or homesteading a farm operated under dry-land conditions within the area above described may make application for a cooperative shelter-belt demonstration on such farm.

(2) Any public school, either in town or in the country, may apply for a demonstration shelter-belt planting, provided such schools have sufficient land suitably located for a planting of this kind. Applications from schools must be signed by some person connected with the school, who will be responsible for the planting and care of the trees.

Trees can not be furnished for setting out in hedges or ornamental groups.

LOCATION AND SIZE OF SHELTER BELTS.

In fixing the location of a shelter belt two important factors must be considered: (1) The direction from which the damaging windstorms come and (2) what the planting is to shelter, whether buildings and barnyards or gardens and orchards.

BUILDINGS AND BARNYARDS.

Winter protection is the important consideration in planning shelter for buildings and barnyards. As the severe winter storms usually come from a northwesterly direction, the trees should be located on the north and west, usually in two strips or belts of uniform width in the form of a right angle. Irregular-shaped pieces of ground do not make satisfactory plantings. Allowance must be made for snow that is almost sure to pile up beyond the inside edge of the planting. A distance of 100 to 150 feet is recommended between the inner edge of the trees and the buildings, feed racks, or water tanks, to avoid the danger of snow drifting against these objects.

A minimum width of 50 feet is advised for any shelter-belt planting, with as much more, to a width of at least 100 feet, as the ground available will permit. The width of a shelter belt has an important effect on the quantity of snow that is likely to pile up in the yard and also the efficiency of the belt in shutting out the wind. A wide belt is especially advantageous in keeping

snow out of the yard, as most of the snow will collect among the trees instead of piling up beyond them as it will with a narrow belt.

A snow trap is an excellent arrangement in places where the control of drifting snow is an important consideration. The snow trap is obtained by laying out the planting in two separate strips in the following manner: On the outside, or side next to the prevailing wind, a narrow belt 30 to 50 feet wide; then an open space 30 to 50 feet wide, and then a belt 50 to 100 feet in width.

ORCHARDS AND GARDENS.

Orchards and gardens need protection from spring and summer winds. Shelter on the west and south is of most importance. A planting on the north may also be beneficial, but it is seldom necessary to afford protection on the east. Snow which may collect in the orchard or garden is likely to be beneficial, so that a width of more than 50 feet in the planting is not as important as in planning shelter for buildings and yards. It should be remembered, however, that trees will send out their roots in cultivated ground for a distance approximately equal to their height and that a space of at least 20 feet from the trees will not be suitable for planting to fruit trees or garden crops but must be considered a part of the shelter belt.

PREPARATION OF THE LAND.

It is not the desire of the Department of Agriculture to add to the burden of the cooperator by insisting upon any rules except such as it is believed will contribute to his chances of success. Under dry-farming conditions trees have a fair chance of success only when they are planted in moist soil, free from sod and grass, and then kept free from all vegetation by clean cultivation until they are large enough to take care of themselves.

Clean summer fallow during the year before the trees are to be planted is the best method of storing moisture in the soil and cleaning it of grass and weeds. The Department of Agriculture therefore will require that the land on which the shelter-belt demonstration is to be placed be cultivated as clean summer fallow during the year previous to that in which the trees are to be set out. An exception to this rule will be made only in cases where the soil is so light that some cover crop is necessary to prevent the soil from blowing.

SIZE AND KIND OF TREES.

Experience has shown that a comparatively small tree, 1 or 2 years of age from seed and from 1 to 2 feet in height, is best adapted for use in shelter-belt plantings. The following is a representative list of the species commonly used:

Box elder, 1-year-old seedlings.
Northwest poplar, 1-year-old rooted cuttings.
Green ash, 2-year-old seedlings.
White elm, 2-year-old seedlings.
Caragana, 2-year-old seedlings.
Russian olive, 1-year-old seedlings.

Certain other species of trees when available may be substituted for or used in addition to the ones named above. It should be clearly understood that the choice of species that go to make up any demonstration planting must conform to the combination designed by the Department of Agriculture and given in the planting plan furnished to each cooperator before any trees are shipped. It sometimes may be possible to make changes in accordance with the wishes of the individuals, but the department reserves the right to cancel the cooperation if the trees selected are not acceptable to the applicant.

INSPECTION.

During the summer, before the trees are to be set out, the Department of Agriculture will send an inspector to visit the farm on which the proposed demonstration is to be made. The inspector will determine the size and shape of the ground that has been prepared for the planting, examine the condition of the soil, and see that all requirements outlined in this circular have been complied with. If in his opinion conditions are favorable, a planting plan will

be prepared and sent to the cooperator during the following winter; and if the plan is acceptable the trees will be shipped in the spring.

If the inspector finds conditions unfavorable for planting the following season, he will advise the cooperator what necessary further preparation or alteration is necessary and either postpone the time of planting for another year or cancel the cooperation, as circumstances may require. The following points may make it necessary to postpone the time of planting or to cancel the application:

(1) If the land has not been kept in clean summer fallow.

(2) If the shelter belt is not properly located to give protection to the buildings, yards, orchard, or garden.

(3) If the size of the piece of ground prepared is not large enough to make an effective shelter belt.

(4) If the location is unsuitable for the growth of trees.

The Department of Agriculture also plans to have an inspector visit the planting during the summer after the trees are planted and for five years thereafter for the purpose of collecting information on the growth and general condition of the trees.

TIME OF PLANTING.

All planting will be done in the spring, usually some time during the latter part of April and the first part of May. Trees will be shipped as early as weather conditions permit.

CULTIVATION OF TREES.

After the trees are planted the ground must be kept clean by frequent cultivation. Grass and weeds are the worst enemies of young trees and if once well started will stunt their growth and eventually destroy the planting. A mulch has not been found a satisfactory substitute for clean cultivation.

SPACING DISTANCES.

No fixed spacing distance has been adopted, as investigation of the question of spacing has not been carried on long enough to determine what will ultimately prove the best distance apart to plant trees for shelter-belt purposes. A spacing of 6 by 10 feet apart has been selected on the basis of present information.

CONCLUSION.

Applications for cooperative shelter-belt demonstrations must be made before June 1 of the year before the trees are to be set out.

The quantity of stock for use in these shelter-belt plantings is limited by the number of trees it is possible to raise in the nursery at the Northern Great Plains Field Station. As it is possible that hail, extreme drought, or scarcity of native-tree seed may unexpectedly reduce the available stock in any one season, applications are accepted with the understanding that in the event of an unexpected shortage of trees demonstrations may be postponed, reduced in size, or canceled.

MARCH 13, 1924.

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D. L. A—2. Issued February 17, 1916.

United States Department of Agriculture,
BUREAU OF PLANT INDUSTRY,
Office of Dry-Land Agriculture,
WASHINGTON, D. C.

COOPERATIVE SHELTER-BELT DEVELOPMENT IN THE NORTHERN GREAT PLAINS.

INSTRUCTIONS FOR PLANTING TREES.

A study of the climatic and soil conditions of the Great Plains region has made it apparent that trees can not be successfully grown in this section without following as closely as possible certain fundamental rules for tree planting.

The following instructions are offered for all shelter-belt cooperators, who are requested to study them carefully and to follow them as closely as conditions will permit.

THE SHELTER-BELT PLAN.

The cooperator's shelter-belt plan accompanies these instructions and shows the following:

1. Name and address of the cooperator.
2. Location of the more important buildings.
3. The location, size, and form of the shelter belt.
4. The lengths and width in feet of each part of the shelter belt.
5. The number of rows to be planted in each part.
6. The number and variety of trees to be planted in each row.
7. The distance between the trees in each row.
8. The distance between the rows.
9. The total number of trees of each kind that will be shipped.

The width shown on the plan includes 4 feet on each side, in addition to the space occupied by the trees, to allow for outside cultivation.

Where the shelter belt is made up of two or more strips which cross each other, forming corners, the trees in the corners should be checked.

In all plans north is at the top of the sheet.

CARE OF TREES WHEN RECEIVED.

Trees will be shipped the latter part of April or the first part of May. On the day that they are sent a notice will be mailed to the cooperator. Every possible effort should then be made to get the trees from the express office at once.

When taking the trees home they should be well covered with blankets to protect them from the wind and sun. On arriving at

the farm the package should be opened in the barn or shed and the roots of the trees well moistened. Cuttings should be treated in the same manner. If the weather permits, the trees should be *planted immediately*. If it is not possible to plant at once, the trees should be "heeled in."

"*Heeling in.*"—Dig a trench 8 or 12 inches deep, with one side sloping, and preferably in some sheltered location. Open the bundles, keeping each variety separate, and place the roots in the trench, with the trees lying against the sloping side. Cover the roots well with moist soil, *packing it firmly against them*. If the soil is dry it should be moistened. It is not necessary to cover the tops of the trees entirely.

To "heel in" cuttings, completely bury them in moist soil, covering them 12 inches deep. It is not necessary to open the bundles.

PLANTING TREES.

Trees may be planted with either a spade or a walking plow.

Planting with a plow.—Set stakes in the row and at the ends and plow out a furrow in line with the stakes. Deepen it by plowing back in the same furrow. The bottom of the furrow should be from 8 to 12 inches below the level of the land surface, depending on the length of the roots of the trees. Carry the trees in a pail of water or carefully wrapped in a piece of wet burlap and plant by holding the tree by the top with the roots in the bottom of the furrow. Pull the soil in from both sides with the feet, *tramping it solidly around the roots*, so that the tree will stand upright. Fill in the furrow with a shovel, hoe, or cultivator and level off the surface. After the surface is level, the trees should stand about an inch deeper than they did in the nursery. In no case should the roots show above the ground, nor should the trees be hilled up.

Do not plow more than one or two furrows at a time. If the furrow is left open too long the soil will become dry, a condition which is very injurious to the trees.

Planting with a spade.—A convenient way to locate the rows is by stretching a line. Small trees may be planted in the following manner: Thrust the spade straight into the ground and pry up the dirt in front of it; then, without lifting out the spade, push it forward and slip the tree in behind it. Spread the roots as much as possible and pull out the spade, allowing the loose dirt to fall back against the roots. Tramp the soil firmly about the roots.

Important points to be observed in planting.—Be sure to keep the trees covered or the roots in water while planting. A few minutes of exposure to hot winds will usually kill small trees.

The best time to plant is on a quiet cloudy or drizzly day. Do not plant on a hot windy day.

Plant the trees as soon as possible after receiving them.

Tramp the soil firmly about the trees.

PLANTING CUTTINGS.

The most important thing in planting a cutting is to tramp the soil firmly against it, especially at the bottom.

After the row has been marked, make a slanting hole with a pointed hoe handle, broomstick, or stout iron rod. The holes should be about an inch less in depth than the length of the cutting.

Insert the cutting and tramp the soil firmly against it, taking care to pack the soil firmly against the lower end of the cutting.

Not more than an inch of the cutting should project above the level of the ground.

Always plant the cutting *with the buds pointing upward.*

A spade may be used in planting cuttings. The method is the same as in planting small trees, except that the spade is pushed into the ground in a *slanting direction* instead of straight down. Proper and improper methods of planting cuttings are shown in figure 1.

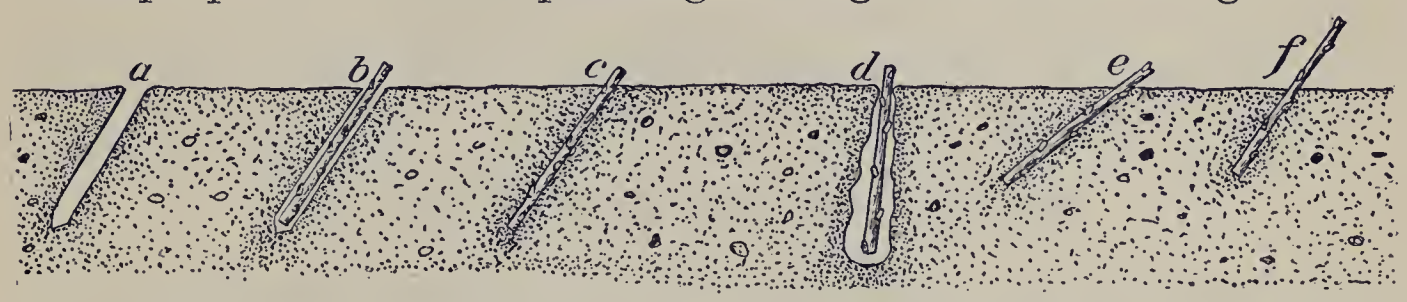

FIG. 1.—Sketch showing proper and improper methods of planting cuttings of trees. Proper method: *a*, A hole made with a pointed stick; *b*, the cutting inserted and projecting an inch or less; *c*, the planting completed, with the soil packed firmly against the entire cutting. Improper method: *d*, Soil left too loose about cutting; *e*, cutting planted too slanting; *f*, cutting planted too shallow. These improperly planted cuttings are all likely to dry out before rooting.

While planting, keep the cuttings in a pail of water.

If the soil is dry, the cuttings should be watered after they are planted. Cuttings will not take root in dry soil.

CULTIVATION.

The trees should be cultivated immediately after they have been planted or as soon thereafter as possible. Do not wait for weeds to appear, but keep the ground clean from the beginning. The cultivator alone will not be sufficient to keep out all grass and weeds. It will be necessary to go through the planting once or twice during the season with a hoe.

Success with trees can not be expected if cultivation is neglected.

It is important that a strip of at least 4 to 10 feet on the outside be kept absolutely free from grass and weeds.

Wherever fire guards or fences are required, they should be provided by the cooperator.

Approved:
WM. A. TAYLOR,
Chief of Bureau.

DECEMBER 20, 1915.

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[This pamphlet is sent out only in connection with the distribution of trees for windbreak demonstrations from the Northern Great Plains Field Station, Mandan, N. Dak.]

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D. L. A.—2
Revised June 1940

United States Department of Agriculture

BUREAU OF PLANT INDUSTRY

Division of Dry Land Agriculture

INSTRUCTIONS FOR PLANTING TREES

SHIPMENT OF TREES

Trees for your windbreak planting will be shipped some time in April, and a notice will be mailed to you on the day the shipment is made. Get them from your local station as quickly as possible.

CARE OF TREES BEFORE PLANTING

Although the trees are packed so that they should keep in good condition in the bundle for a period of 2 weeks, they should be unpacked as soon as received. Open the bundle in some cool, protected place. Cut the string that holds the bale of trees together. Sort out and check the number of trees of each kind, to see that you have received the number called for by the planting plan. It will not be necessary to open the small bunches in which the trees are tied. A list of the required number of trees will be found on the back of the shipping tag enclosed in the bundle of trees.

Wet the roots of the trees thoroughly, either by pouring water over them or by submerging them in a pail or tub of water for a few minutes, and then heel in as directed below. If planting is started at once, heeling in may not be necessary, as the trees may be kept for a short time by wetting down the packing material and repacking it about the roots. A cool cellar or barn is a suitable place to keep trees packed in this way.

HEELING IN

Dig a trench the width of an ordinary plow furrow and about a foot deep, with one side sloping. The dirt from the trench can be placed along the sloping side to increase its height. Lay the small bunches of trees against the sloping side, roots resting in the bottom of the trench, tops pointing up the slope, as shown in figure 1. Fill dirt against the trees so as to cover completely the roots and a portion of the tops, packing it well. If the soil is at all dry it should be well soaked with water after the heeling in is completed.

Trees will remain dormant longer if heeled in in a cool, shaded location than if placed where they will be exposed to the warm rays of the sun. Do not leave trees heeled in after they show signs of

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starting to send out leaves. If this occurs they should be planted without delay.

PLANTING TREES

The trees should be planted as soon as possible after they are received. Endeavor to have the planting completed before they show any signs of starting to send out leaves.

Consult the prepared planting plan before setting out the trees. The position of the rows as shown on the planting plan should first be marked on the ground. Any practical method for assuring straight rows may be used, such as setting stakes or stretching a line. Care should be taken to get the correct distance between rows and between the trees in the row.

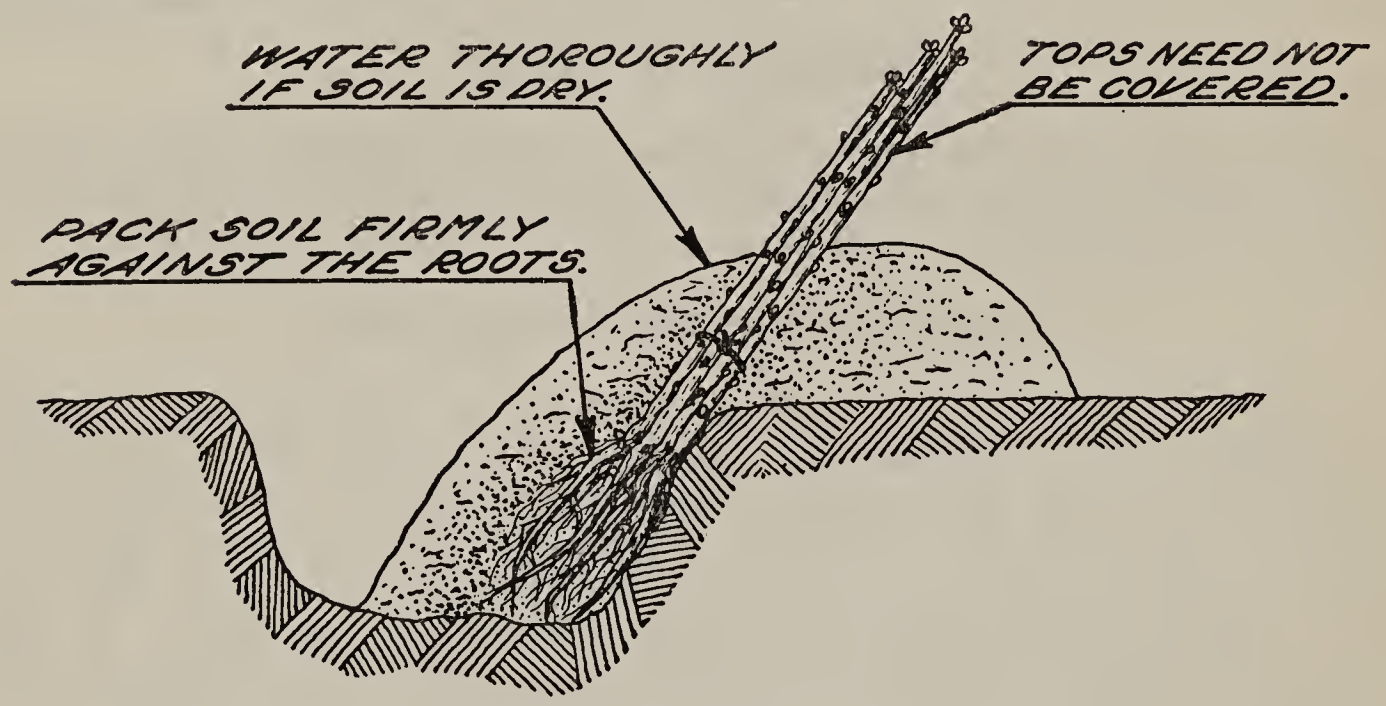

FIGURE 1.—Heeling in small bunches of trees.

A spade or a straight long-handled shovel makes the best planting tool. The trees may be planted by either the hole or the slit method, depending on the root system of the stock to be planted. Stock with spreading roots will require a hole, whereas stock with very small or few lateral roots can be planted satisfactorily behind the spade or by the slit method.

Trees cannot be successfully plowed in, but the planting work may be reduced by plowing a deep furrow and then digging in the bottom of the furrow. This practice is not recommended except in wet weather, as it tends to dry out the soil around the root area.

Whatever method is used for planting, the following fundamental principles should be observed: (1) Keep the roots of the trees moist at all times by carrying them in a pail of water or wrapped in a wet sack; (2) make the hole or slit wide and deep enough to fit the roots of the stock to be planted; (3) set the tree a little deeper than it stood in the nursery; (4) pack the soil firmly about the roots. The soil should come in contact with all roots and be well firmed so that after the planting operation is completed it will not be possible to move the tree with a fairly strong pull of the hand.

Correct and incorrect planting practices are shown in figure 2.

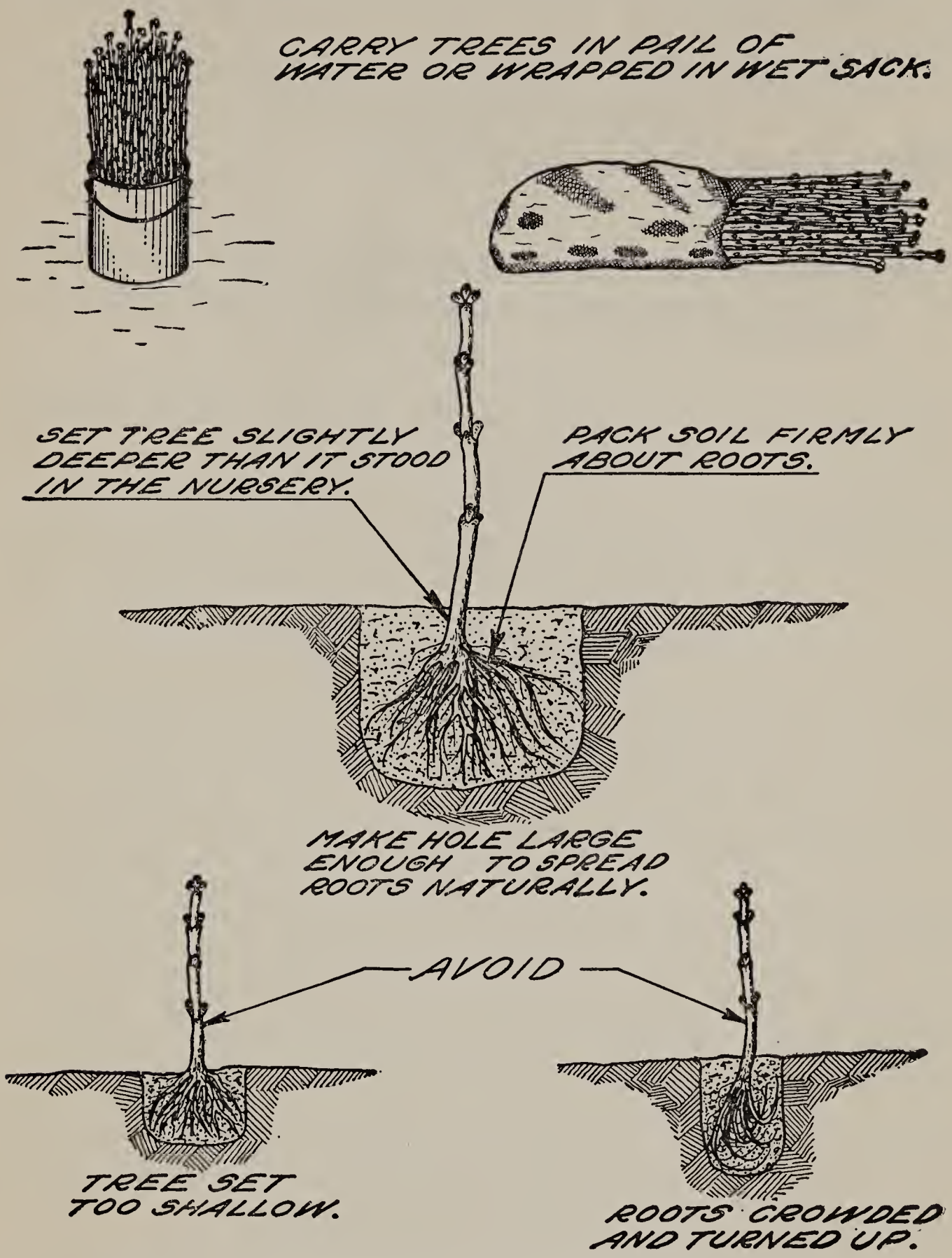

FIGURE 2.—Correct and incorrect practices in planting trees.

U. S. GOVERNMENT PRINTING OFFICE: 1940

D. L. A.—3. Issued March 3, 1917.

United States Department of Agriculture,
BUREAU OF PLANT INDUSTRY,
Office of Dry-Land Agriculture,
WASHINGTON, D. C.

COOPERATIVE SHELTER-BELT DEVELOPMENT ON THE NORTHERN GREAT PLAINS.

INSTRUCTIONS FOR THE PREPARATION OF THE LAND FOR SHELTER-BELT PLANTING.

IMPORTANT NOTICE.—It is especially important that the following instructions regarding the *location of the shelter belt* and the *preparation of the land* be carefully read and complied with.

LOCATION OF THE SHELTER BELT.

(1) Do not locate the shelter belt closer than 100 feet to the principal buildings.

(2) Locate the shelter belt on the north and west or south and west of the buildings.

(3) Each part of the shelter belt should be from 40 to 100 feet wide and from 300 to 500 feet long.

(4) Each part should be of the same width for its entire length unless some natural obstruction interferes.

Where roads, boundary lines, or the lay of the ground interfere, the shelter belt may be located closer than 100 feet to the buildings. In such cases, however, inconvenience from drifting snow is likely to result.

The shelter belt should be located only on the sides where it will give protection from the prevailing winter winds.

PREPARATION OF THE LAND.

Too much care can not be taken in getting the soil thoroughly worked up and the sod completely rotted. On new ground it will usually be necessary to do the breaking at least two years before planting the trees.

During the year before the trees are planted prepare the land in the following manner:

Plow in the fall and leave the ground rough over winter. The plowing should be 8 inches deep on medium and heavy soil and not over 5 or 6 inches deep on light sandy soil.

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Disk and harrow the ground as soon as it can be worked in the spring.

During the remainder of the summer, disk, harrow, or cultivate as often as is necessary to keep the ground clean of weeds, grass, or other vegetation. Clean summer fallow of this type is the best method of preparing land for the planting of trees.

Spring plowing may be practiced instead of fall plowing, in which case the land should be disked and harrowed immediately after plowing. Spring plowing must not be done later than June 1.

It should be understood that the cultivation of the land above described is for the preparation of the soil before the trees are planted and does not refer to the cultivation of the trees.

At the end of the season, the preparation of the land to lie over winter will depend somewhat on the nature of the soil. Ordinary clay soil will need no further treatment. Light sandy soil which may be damaged by blowing should be ridged by going over it with an ordinary cultivator. Ridging the soil in this manner, if properly done, will greatly lessen the damage from blowing.

Land should *not* be plowed in the spring before planting the trees.

In exceptional cases land may be planted to potatoes, corn, or some garden crop. Where this is done, frequent cultivation must be practiced to keep the crop clean of weeds at all times. Clean summer fallow should be practiced where possible.

Under no circumstances will trees be furnished for planting on ground that has been cropped in grain, alfalfa, or sweet clover the previous year. If winter wheat or rye has been planted on land that is to be prepared for trees, it should be plowed under not later than the middle of May and handled as summer fallow during the remainder of the season.

FENCING.

Before the trees are planted, arrangements should be made for the construction of a suitable fence to keep out all classes of stock. Rabbit-proof woven wire is the best type for this purpose.

Approved:

WM. A. TAYLOR,
Chief of Bureau.

FEBRUARY 17, 1917.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1917

D. L. A.—4. Issued April 18, 1919.

United States Department of Agriculture,
BUREAU OF PLANT INDUSTRY,
Office of Dry-Land Agriculture,
WASHINGTON, D. C.

CARE OF COOPERATIVE SHELTER BELTS ON THE NORTHERN GREAT PLAINS.

INSTRUCTIONS FOR THE CARE OF SHELTER BELTS AFTER PLANTING.

It is especially important that these instructions in regard to the care of shelter belts after planting should be *carefully read* and *complied with.*

Shelter-belt plantings on the northern Great Plains can not be treated as individual trees, groves, windbreaks, or wood lots are treated in the older settled parts of the country farther east and south. The semiarid conditions prevailing here require different methods of culture in order ultimately to approximate natural forest conditions.

This forest condition is a heavy, compact, untrimmed growth of sufficient density to form a complete shade. This shade keeps out most of the weeds that would otherwise use moisture. It also aids in reducing evaporation. The leaves that fall form a natural mulch, and the heavy accumulation of snow retained in the winter insures an amount of moisture in the spring above the normal.

The spacing distance, together with the continual cultivation until the trees become too thick to work among, assures good-sized trees to form a dense shade.

Until this desired condition is reached all grass and other weeds must be kept out. One summer's growth of Russian thistles or western wheat-grass may kill out a previously healthy shelter belt of two or three years' standing.

CULTIVATION.

Cultivation of the trees in the shelter belt should be frequent enough to keep all weeds from obtaining a foothold. This applies especially to western wheat-grass, often called "bluestem." This grass grows very quickly on newly broken ground and if allowed to spread forms a sod within one season. If not removed as soon

as it starts it is very difficult to kill and will require plowing, which is not the proper treatment for the shelter belt.

Cultivation with a 1-horse cultivator should be continued until about the middle of August. Later work to keep the shelter belt free from weeds should be by hand hoeing or pulling. This applies to Russian thistles, tumbling mustard, and other quick-growing large weeds. Do not allow these weeds to remain in order to "catch the snow." The trees will do that without assistance. The weeds not only use needed soil moisture, but cause further trouble by disseminating seed. Thorough cultivation should be practiced every season until the trees have reached such a size as to make it impossible to work between the rows with the 1-horse cultivator.

MULCHING.

The artificial mulching of shelter-belt trees with straw, manure, or any similar material is not recommended, for the reason that there is insufficient experimental evidence of its beneficial effect; and it is well known that it may be harmful in many ways, such as furnishing harbors for mice, introducing weed seeds, and increasing the danger from fire.

After the trees become too large and close together to cultivate the falling leaves will form their own mulch. This is the natural forest condition in which they will best thrive.

PRUNING.

Do not prune your shelter-belt trees. A thick, dense growth is the only proper method of growing a shelter belt. The reasons are as follows:

(1) It is the natural method of growth, affording protection from the hot sun and drying winds of both summer and winter to the trees making up the shelter belt.

(2) The bushy natural growth protects the trunks of the trees from sun scald, which may weaken, badly damage, or even kill the trees.

(3) Unpruned trees soon interlap and shade the ground. This prevents the growth of grass and weeds and checks the loss of water from the soil.

(4) An unpruned shelter belt will afford protection to itself from wind. The individual trees will not be switched around by heavy winds until they become loosened and dry out, as they may be when trimmed up from 2 to 5 feet.

(5) Unpruned trees will sooner protect your buildings, garden, and stock, which is the purpose for which the shelter belt was planted.

EXCEPTIONAL CONDITIONS SOMETIMES JUSTIFY PRUNING.

If the young trees are frozen to the ground for a few years in succession they will become too bushy at the base and make no growth in height. To stimulate an upward growth, cut away all branches

except one at the ground close to the trunk. Allow this to become the leader for a new trunk. Do not prune the branches that it sends out, but allow it to grow as bushy as it will.

Dead wood should be removed. Cut the branches close to the living wood and leave no stubs.

INSECT PESTS.[1]

In common with all other plants, trees are subject to the attacks of certain insect pests. Poplar beetles and their black larval or wormlike stages eat willow and poplar leaves. These beetles suggest the Colorado potato beetle in shape, but they are somewhat smaller and are black in color tinged with blue and more or less striped or spotted with yellow or orange. They appear when the leaves begin to come out in the spring and are at their worst during the month of June, though if not killed they may produce from four to five generations before fall, with disastrous results to the foliage and the subsequent death of the trees. Spraying with lead arsenate, prepared as directed by manufacturers on the containers, will effectually kill them. The spraying will yield most satisfactory results if done when the leaves are about half grown. A heavy reappearance of the beetles may necessitate repetition of the treatment during the season.

The large, green, wormlike larvæ of certain moths are very destructive to the foliage of poplars and box elders. One large worm may eat all the leaves on a young tree in a short time. A thorough spraying of lead arsenate should control this pest. Hand picking is also often resorted to.

Leaf miners work between the two surfaces of a leaf, either eating all the inner tissues or merely eating a tunnel in the leaf until they come out. The leaf turns black when all the tissue is eaten or shows a brown track when tunneled. As these insects are protected by the leaf surface, it is rather difficult to control them. They generally do not come in numbers large enough to do a great deal of damage. They work almost wholly on the poplar, but are occasionally seen on the box elder. A lead-arsenate spraying as soon as the leaves are formed should kill the miners before they penetrate the leaf surface.

The leaf-cutter bees may be destructive to the leaves in cutting out small circles for their nests. While they will often cut the leaves of an ash, or sometimes a box elder, to a skeleton, they do not seem to damage the tree as far as its growth is concerned. They generally work during midsummer after the tree has made its growth. As they do not eat the pieces of leaves cut, they can not very well be destroyed by poison spray.

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[1] These statements in reference to insects have been approved by the Bureau of Entomology.

Blister beetles are found on the young shoots of the caragana in the month of June. They are of three kinds, the gray and the black (about three-fourths of an inch to 1 inch long), and the metallic blue (1 to 2 inches long). Spraying does not seem to kill them, but drives them to other plants. The caragana does not seem to suffer much from them and will often put out new leaves after being eaten. Blister beetles also attack alfalfa and beans in restricted spots.

ANIMAL PESTS.

The jack rabbit is the worst animal pest with which the grower of trees has to contend. It not only strips the bark from the older trees but will cut off seedlings at the ground or snow line. It especially prefers elm and ash, but will cut off poplar and willow branches in the winter where they protrude above the snow. Rabbits, however, like alfalfa better than trees; and if a stack of alfalfa is near by, they will very seldom bother the trees. The following formulas for poisoning them are recommended by the United States Biological Survey:

Poisoned oats.—Heat 1½ pints of water to boiling. Add 1 ounce of salt. Dissolve 2 ounces of laundry starch to the consistency of thick cream and add to the salt water. Stir well and add 1 ounce of strychnin and 1 ounce of baking soda. Mix thoroughly and pour while hot over 12 quarts of oats, wheat, or corn. Place in piles on shingles at intervals along the edge of the shelter belt out of the reach of stock. If placed at night and removed in the morning, the danger of poisoning chickens and birds will be minimized. This bait is also effective for mice.

Poisoned alfalfa leaves.—Dissolve 1 ounce of strychnin sulphate in 2 gallons of hot water and sprinkle over 10 pounds of alfalfa hay leaves. Mix the leaves thoroughly until all moisture is absorbed.

Poison wash.—Dissolve 1 ounce of strychnin sulphate in 3 quarts of boiling water. Dissolve half a pound of laundry starch in 1 pint of cold water, stirring thoroughly. Pour the starch into the vessel containing the strychnin and boil the mixture a short time until the starch is clear. Add 6 ounces of glycerin and stir. Wheen cool enough, apply to the tree trunks with a paint brush. As the shelter belt is fenced, no danger from stock can occur.

Stock of all kinds eat the branches and leaves of both young and old trees. It is necessary, therefore, to have the shelter belt fenced securely at all times. This is required by the agreement by which the farmer receives the assistance of the Department of Agriculture, and a failure to provide this fence is sufficient cause for canceling cooperative work with any farmer.

DISEASES.

Trees are also subject to disease, but the varieties used in the cooperative shelter-belt work have only a few serious diseases.

Poplars are subject to canker. This appears as a swelling on the side of the trunk or at a crotch. When in the earlier stages it cracks

open and a brownish fluid flows from it. When the canker is older the central part dies and the bark breaks away; the limb above the diseased portion dies, as the disease girdles the tree. It works down through the woody tissue and is more extensive than is apparent on the surface. The only safe course is to root out the tree and burn it. Unless the branch on which the canker occurs is cut back for some distance below the outside swelling it does but little good to prune.

Willows are sometimes affected by a disease which turns the branches black, beginning with the tip. The branches may be cut back; but as this disease also works under the bark more than is apparent on the outside, digging out and burning the entire tree is to be recommended.

Approved:

WM. A. TAYLOR,

Chief of Bureau.

FEBRUARY 11, 1919.

PUBLICATIONS OF THE U. S. DEPARTMENT OF AGRICULTURE OF VALUE IN CONNECTION WITH TREE PLANTING IN THE NORTHERN GREAT PLAINS.

AVAILABLE FOR FREE DISTRIBUTION.

Box Elder (*Acer negundo*). (Forestry Circular 86.)
Green Ash (*Fraxinus lanceolata*). (Forestry Circular 92.)

FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C.

Windbreaks: Their Influence and Value. (Forestry Bulletin 86.) Price, 30 cents.
The Northern Hardwood Forest: Its Composition, Growth, and Management. (Department Bulletin 285.) Price, 20 cents.
How to Cultivate and Care for Forest Plantations on the Semiarid Plains. (Forestry Circular 54.) Price, 5 cents.
How to Transplant Forest Trees. (Forestry Circular 61.) Price, 5 cents.
White Elm (*Ulmus americana*). (Forestry Circular 66.) Price, 5 cents.
Scotch Pine (*Pinus sylvestris*). (Forestry Circular 68.) Price, 5 cents.
Cottonwood (*Populus deltoides*). (Forestry Circular 77.) Price, 5 cents.
White Willow (*Salix alba*). (Forestry Circular 87.) Price, 5 cents.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1919

[This pamphlet is sent out only in connection with the distribution of trees for shelter-belt demonstrations from the Northern Great Plains Field Station, Mandan, N. Dak.]

D. L. A.–4

Issued April 18, 1919
Revised April, 1930

United States Department of Agriculture

INSTRUCTIONS FOR THE CARE OF SHELTER BELTS AFTER PLANTING

Compiled in the Office of Dry-Land Agriculture, Bureau of Plant Industry

CONTENTS

The following instructions are given to shelter-belt cooperators to assist them in obtaining the best results with their plantings.

Because of the climatic conditions, plantings of trees on the northern Great Plains require different methods of treatment from those applicable to sections where conditions are more favorable. The arrangement of the different kinds of trees and the spacing distances used in shelter-belt planting are intended to favor a growth, as the trees get older, that will more or less completely shade the ground and keep out grass and weeds. Until this shade has been attained it is essential that the soil be given careful cultivation to prevent the growth of grass and weeds.

CULTIVATION

Cultivation to control the growth of weeds is the primary problem in the care of trees on the Great Plains. Cultivation also leaves the surface of the soil in a condition that favors the penetration of water and tends to prevent loss of moisture through soil cracks. Grasses and weeds are perhaps the worst enemies of young trees, so cultivation should be practiced for several years or as long as it is possible to work between the trees. Some form of shovel cultivator makes the best type of implement for cultivation purposes. A double disk does satisfactory work under certain conditions. A single disk, however, should be avoided, as its continued use results in the soil being thrown from the center of the row against the trees.

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MULCHING

The mulching of trees with straw or manure as a substitute for cultivation has been tested, but the results do not warrant the recommendation of this practice. In addition to the fact that mulching has no beneficial effects, certain harmful conditions have been observed, such as furnishing harbors for mice which damage the trunks of trees, introducing weed seeds, increasing the fire danger, and preventing light rainfall from reaching the soil.

PRUNING

Pruning has a very limited application in a shelter-belt planting and unless intelligently done will result in serious damage to the trees. Each branch helps to shade the ground and protect the trunk from sun scald and increases the ability of the tree to break the force of wind and hold snow. Damage to the top of a young tree by mechanical means or climatic conditions often results in several shoots coming up from the base of the tree. Pruning to remove these shoots can be advantageously carried out so that a tree with a single central trunk may be developed.

Ordinarily pruning should be done the first and the second spring after planting and should be limited to trees which under natural conditions grow with a single central trunk, such as ash, elm, poplar, and boxelder. Side branches from the central trunk should not be removed from a greater height than a foot above the ground level. The pruning of hedge-type trees, such as Siberian pea-tree and Russian-olive when planted in outside rows, should be avoided, as branching close to the ground is desirable in order to break effectively the force of wind and snow.

FENCING

A good fence that will keep out all forms of domestic livestock is essential to the success of a shelter-belt planting. A woven-wire fence that will keep out rabbits makes the best type of fence for this purpose.

CONTROL OF ANIMAL PESTS

Jack rabbits often cause serious damage to shelter-belt plantings by eating the tops of young trees and stripping the bark off older ones just above the snow line. Field mice frequently girdle trees near the base with serious results. Directions for destroying these rodents, as furnished by the Bureau of Biologcial Survey, are as follows:

JACK RABBITS

Poisoned alfalfa leaves.—Dissolve 1 ounce of strychnine sulphate in 2 gallons of hot water and sprinkle over 12 pounds of clean alfalfa hay leaves. Mix the poisoned leaves thoroughly until all moisture is absorbed. Should strychnine alkaloid be used, 1 quart of vinegar should be substituted for 1 quart of water in preparing the solution, and equally good results will be obtained.

Poisoned oats.—Mix 1 tablespoonful of starch in one-half cup of cold water and stir into 1 pint of boiling water to make a thin clear paste. Mix 1 ounce of powdered strychnine with 1 ounce of powdered bicarbonate of soda

(baking soda) and stir with the starch to a smooth creamy mass. Stir in 1 teacup of table salt. Apply to 12 quarts of good clean oats and mix thoroughly to coat each kernel. Each quart should make from 25 to 30 baits.

The poisoned baits should be distributed in the evening by placing small handfuls in lines a few feet apart along the rabbit runways. If all baits remaining uneaten are removed the following morning, there will be less danger of poisoning domestic livestock.

FIELD MICE

Starch-coated grain bait.—Mix 1 tablespoonful of gloss starch in one-half teacup of cold water and stir into three-fourths pint of boiling water to make a thin clear paste. Mix 1 ounce of powdered strychnine with 1 ounce of baking soda and stir into the starch to a smooth creamy mass free of lumps. Stir in one-fourth pint of heavy corn sirup and 1 tablespoonful of glycerine. Apply to 12 quarts of wheat or to 20 quarts of steam-crushed oats and mix thoroughly to coat each kernel.

Steam-crushed whole oats are preferable, as they may be distributed promiscuously over the infested area without endangering bird life. The poisoned bait should be scattered along runways and within entrances of burrows, a teaspoonful at a place. Wheat, however, in order not to endanger birds, should be placed inside the mouse tunnel openings, under dense cover, or in poison stations.

CONTROL OF INSECT PESTS

The usual forms of insects that injure shelter-belt trees are those that eat the leaves, those that suck juices from the leaves or through the bark, and those that bore in the trunk and branches. The best general methods of control as approved by the Bureau of Entomology are as follows:

LEAF-EATING INSECTS

Leaf-eating insects include the caterpillars, blister beetles, and other forms that chew up and swallow bits of foliage. In combating these forms, use a spray of lead arsenate, soap, and water, prepared by mixing 1 pound of powdered lead arsenate and 3 cakes of common laundry soap in 50 gallons of water. If smaller quantities are desired, use 3 teaspoonfuls of the lead arsenate and a small piece of soap in 1 gallon of water. Mix thoroughly before spraying, and cover all of the foliage with the spray. Apply this poisonous mixture as soon as the insects or the leaf-eating work appears.

LEAF-SUCKING INSECTS AND MITES

The leaf-sucking forms include the plant lice and the mites, or spider mites, which suck out the sap but do not chew up or swallow the leaf tissue. In combating these forms, spray with a nicotine sulphate soap solution prepared by dissolving one-quarter pound of soap and one-half ounce of 40 per cent nicotine sulphate in 2 gallons of water. This solution will usually have to be applied twice at intervals of about a week or 10 days for good control. The treatment should be very thorough, wetting every part of the trees above ground with the spray, and particularly both sides of the leaves.

SUCKING INSECTS INFESTING THE BARK

The bark-sucking insects include the scales. In combating these forms, use a dormant strength miscible oil or lubricating-oil emulsion spray, preparing it according to the directions of the manufacturer of the brand purchased and applying it as indicated, while the trees are dormant. Usually these materials give the best results if used in the late fall or in the early spring just before new growth starts. The infested portions of the tree should be thoroughly covered with the spray, but the spray material should not be allowed to accumulate on the ground under the tree, where it may injure the roots.

BORING INSECTS

The boring insects include bark-boring and wood-boring grubs. Many of these species present special problems, and the general recommendations for control usually consist in methods of preventing infestation. These are: (1) Keeping the trees in good, healthy, vigorous growing condition; (2) treating all wounds, first cleaning them, cutting down to sound wood, and then painting the exposed surfaces; (3) destroying all borer-infested material throughout the vicinity as soon as found.

EQUIPMENT

Equipment for successfully fighting insects consists of a rope, ax, saw, chisel, mallet, hammer or hatchet, lead paint or shellac, and brush, knife, measuring utensils for weight and fluid measure, lead arsenate, nicotine sulphate (40 per cent), soap (fish-oil or common laundry), and a compressed-air or barrel-type sprayer, hose, spray rod, and nozzles.

GENERAL

Cooperators desiring more detailed information on any factor regarding the care of their shelter-belt plantings should write to the Northern Great Plains Field Station, Mandan, N. Dak.

Should any serious infestation of insect or other pest occur, write to your State agricultural college or to the United States Department of Agriculture, Washington, D. C., for specific recommendations for control.

U. S. GOVERNMENT PRINTING OFFICE: 1930

D. L. A.—5. Issued April 18, 1919.

United States Department of Agriculture,
BUREAU OF PLANT INDUSTRY,
Office of Dry-Land Agriculture,
WASHINGTON, D. C.

CONIFER ADDITIONS TO SHELTER BELTS ON THE NORTHERN GREAT PLAINS.

SUITABILITY OF EVERGREENS FOR SHELTER BELTS.

In cooperating with the farmers of the northern Great Plains in shelter-belt development the Department of Agriculture endeavors to provide trees that will withstand the semiarid conditions of this area.

It is well known that coniferous trees, commonly called evergreens, require less moisture and are able to withstand conditions more severe than those endured by the broadleaf or hardwood trees. It is, therefore, evident that conifers (evergreens) are even more suitable than hardwoods for such shelter belts. Conifers are more tender when young and require protection from the steady drying winds of winter and summer that prevail over this region. When conifers once become firmly established, they will form a permanent protection the year round, long after the quicker growing trees have disappeared.

In providing these trees only those will be used that are of extreme hardiness and grow naturally in districts where the conditions are severe. In order to assure as complete success as possible, the applicant is requested, as his part of the cooperation, to follow the instructions contained in this circular.

Under the restrictions as outlined, the Department of Agriculture will furnish the tree material necessary for planting a demonstration conifer shelter belt without charge, except that the cooperator will be required to pay express or mail charges on such trees from Mandan, N. Dak. The cooperator will furnish all labor required in preparing the ground and in planting and cultivating the trees and will provide necessary protection against injury from live stock and fire.

Farmers wishing to cooperate in the planting of such conifer shelter belts should make application on the form provided for this purpose, a copy of which accompanies this circular. Farmers who already are cooperating with the Department of Agriculture in shelter-belt work need not make a further application.

Before filling out the application blank this circular should be carefully read, to avoid all possibility of misunderstanding the conditions under which the conifer plantings are made.

TERRITORY COVERED.

The territory covered by this work is that part of North Dakota and South Dakota lying west of the one-hundredth meridian and that part of Montana and Wyoming which lies east of the 5,000-foot elevation line. This will be understood to include the following counties: In North Dakota—Bottineau, McHenry, Sheridan, Burleigh, Emmons, and all counties west; in South Dakota—Campbell, Walworth, Potter, Sully, Hughes, Lyman, Tripp, and all counties west; in Montana—Teton, Lewis and Clark, Meagher, Park, and all counties east; in Wyoming—Sheridan, Johnson, Natrona, Carbon, and all counties east.

WHO MAY COOPERATE.

It is necessary that young conifers have protection during the first few years after they are planted. Only those applicants will be accepted as cooperators who have demonstrated by the successful growth of a shelter belt that they can and will care for trees. Favorable consideration, therefore, will be given the following applicants only:

(1) Public schools or farmers who have satisfactorily cooperated with the Department of Agriculture in growing shelter belts, as outlined in the circulars covering such work.

(2) Public schools or farmers who at the time of planting conifers have for their protection adequate shelter belts which are properly located and show that care has been given them.

No conifers will be furnished for planting on land that is irrigated or likely to be irrigated, as this work is limited to the growing of trees under dry-land conditions.

No conifers will be furnished for planting on town or village lots.

LOCATION AND SIZE OF CONIFER SHELTER BELTS.

As in planting a hardwood shelter belt, it is necessary that the conifers be placed at least 100 feet from the farm buildings. The conifer rows must also be placed where they will receive the protection of the larger trees already planted. This will generally be on the side toward the buildings.

The conifers form a thicker growth than the hardwoods and therefore will not need to be planted in such wide belts. Not more than

three to five rows the entire length of the older shelter belt will be needed.

Conifers will not succeed on alkaline soils, and such land should not be prepared for them.

INSPECTION.

During the summer before the conifers are to be sent out, a representative of the Department of Agriculture will visit the farm on which the proposed planting is to be made, for the purpose of seeing that the farmer clearly understands the plan to be followed. He will determine whether the conifer rows have been well located and whether the ground has been properly prepared for planting. If in his opinion the conditions are favorable, he will make a sketch showing the location and size of the proposed planting and its relation to the trees already growing and to the buildings. From this drawing a detailed plan will be made, showing the number of rows, the kind of trees to be planted in each row, and the spacing distance of the trees in the row. A copy of this plan will be sent to the farmer for his guidance in planting. Trees will be furnished in number and kind as shown on this plan.

If the representative of the Department of Agriculture finds the conditions unfavorable for planting the following season, he will advise the farmer of the preparation necessary to be made and either postpone the application to some future date or cancel it, as the applicant may direct.

In exceptional cases where it will not be possible to visit the applicant, the necessary information will be secured by mail.

The following conditions may make it necessary to postpone or to cancel an application:

(1) If the preparation of the land does not meet the requirements outlined in this circular.

(2) If the conifer rows are not located so as to receive protection from the taller trees already growing.

(3) If the area of land prepared is not sufficient to make a suitable planting.

(4) If the location is obviously unsuitable for the growth of trees.

(5) If the location is closer than 100 feet to the farm buildings.

KINDS AND NUMBER OF TREES.

The coniferous trees used in these plantings will be western yellow or bull pine, jack pine, Scotch pine, lodgepole pine, Black Hills spruce, Canadian white spruce, or any other conifer that may prove suitable and adapted to the severe conditions under which they are to be grown.

On account of the extreme care with which the trees should be planted, large numbers will not be sent at a time. Where trees on more than one side are necessary to complete the shelter belt, enough

for only one side will be furnished. The remainder will be sent the following year provided the ground is prepared for them. As the young conifers are more difficult to get started and make a slower growth than the hardwoods, replacement of dead trees will be made for a longer time. In order to receive these replacements, it will be necessary for the cooperator to report on the blanks furnished for this purpose or by letter, stating the exact number of each kind that have died during the season. This count should be taken at some time between the middle of August and the first of October.

As the stock is too tender to handle over at the time of shipping in order to pick out the exact number of trees for each individual planting, trees will be sent in bundles made up of smaller bunches of either 50 or 100. All trees in excess of the number called for in the plan should be planted in rows in the garden, spaced about 6 to 8 inches in the row. These can be used for replacements the following spring.

SIZE OF TREES.

The stock used will be from 3 to 6 years old, depending on the kind of tree, and will be grown in the seed beds 2 years and then transplanted to the field, where the trees will be allowed to grow from 1 to 4 years before they are sent to the cooperator. They will then range from 6 to 18 inches in height. The pines will be from 3 to 4 years old and 8 to 18 inches high. The spruce will be from 5 to 6 years old and 6 to 12 inches high.

PREPARATION OF THE LAND.

Too much care can not be taken in getting the soil thoroughly worked up and the sod completely rotted. On new ground it will usually be necessary to do the breaking at least two years before the planting is made, at which time it should be in the best garden condition.

During the year before the trees are planted prepare the land as follows:

(1) Plow in the fall and leave the ground rough over winter. The plowing should be 8 inches deep on medium heavy soil and not more than 5 or 6 inches deep on light sandy soil.

(2) Disk and harrow the ground as soon as it can be worked in the spring.

(3) During the remainder of the summer disk, harrow, or cultivate as often as is necessary to keep the ground free of weeds or other vegetation. Clean summer fallowing in this manner is the best method of preparing land for the planting of trees.

(4) Spring plowing may be practiced instead of fall plowing, in which case the land should be disked and harrowed immediately after plowing. Spring plowing must not be done later than June 1.

(5) At the end of the season the preparation of the land to lie over winter will depend somewhat on the nature of the soil. Ordinary clay soil will need no

further treatment. Light sandy soil, which may be damaged by blowing, should be ridged by going over it with an ordinary cultivator. Ridging the soil in this manner, if properly done, will greatly lessen the damage from blowing.

Land should *not* be plowed in the spring before planting the trees.

In exceptional cases the land may be planted to potatoes, corn, or some garden crop. Where this is done, frequent cultivation must be practiced to keep the crop clean of weeds at all times. Clean summer fallow should be practiced where possible.

Under no circumstances will conifers be furnished for planting on ground that has been cropped the previous season to grain, alfalfa, or sweet clover. If winter rye or wheat has been planted on land that is to be prepared for trees, it should be plowed under not later than the middle of May and the land handled as summer fallow during the remainder of the season.

It should be understood that the cultivation of the land above described is for the preparation of the soil the season before planting the trees, and does not refer to the cultivation of the trees after they are planted.

FENCING.

As the older shelter belt has already been inclosed by a suitable fence, it may be necessary to move it so as to include the conifer rows within the inclosure. No trees will be furnished where live stock of any kind are allowed to run among them.

SHIPMENT OF TREES.

Trees will be shipped from Mandan, N. Dak., by parcel post when practicable, provided the necessary stamps have been received. Cooperators will be notified about a month in advance of the time of shipment of the postage required. If this postage is not received at the time of shipping, the trees will be sent by express, charges collect, unless the applicant lives at a great distance from the nearest express office. In such cases the shipment will not be made, as the trees would in most cases be dry, which with the conifer means *dead*, before the farmer could get them after receiving notice of their arrival.

The trees will be shipped in bundles that will allow free access of air to the tops. The roots will be packed in moist shingle tow to prevent drying out, wrapped in waterproof paper, and the entire bundle sewed in burlap.

Young conifers especially are very tender and susceptible to injury. If the roots are exposed to the air even for a few minutes they will become dry and can not be revived and will be worthless for planting. Special care must be exercised in handling the stock if a successful planting is desired. Trees should not be allowed to remain at the post office or express office longer than is necessary. If they can not be planted at once upon their receipt, the roots should be

moistened by pouring water over the stems at the top of the bundle and allowing it to trickle down into the roots and packing. Be sure to pour the water inside of the paper wrapping. The tops should not be wet. If weather conditions are such as to prevent planting for a few days, they had better be heeled in outside. When heeling in, cover the roots well with moist soil, packing it firmly against them. If the soil is dry, it should be moistened before heeling in. In doing this, *do not cover the tops of coniferous trees.*

SPACING DISTANCES.

The spacing distances designated in the planting plan are such as are believed to be best suited to semiarid conditions, and the farmer is requested to observe these spacings as his part of the cooperation. The plans will call for rows from 6 to 8 feet apart, with the trees from 3 to 4 feet apart in the rows. Close spacing makes clean cultivation more certain and at the same time shortens the period of cultivation. Under dry-land conditions the great danger to a plantation of trees is from the intrusion of grass and other weeds which use the available moisture. The sooner the trees grow together and shade the ground the sooner this danger will be passed.

HOW TO MAKE APPLICATION FOR TREES.

If, after carefully reading this circular, the farmer wishes to make an application for an additional conifer planting, he should first determine whether or not his farm lies within the region to which the work is limited, as described under "Territory covered." He should then carefully fill all the blank spaces on the inclosed application and mail it to the Northern Great Plains Field Station, Mandan, N. Dak.

Applications must be sent in before April 1 of the year previous to the time the planting is to be made. For example, an application for trees to be sent out in the spring of 1920 must be received on or before April 1, 1919. If the application is received after that date the trees can not be furnished until 1921. As the quantity of stock which will be produced is limited, in case the applications of any one year exceed the quantity of stock available, it will be necessary to limit the number of cooperators accepted in any one locality or the quantity of stock furnished to each cooperator.

Approved:

WM. A. TAYLOR,
Chief of Bureau.

FEBRUARY 5, 1919.

PUBLICATIONS OF THE U. S. DEPARTMENT OF AGRICULTURE OF VALUE IN CONNECTION WITH TREE PLANTING ON THE NORTHERN GREAT PLAINS.

AVAILABLE FOR FREE DISTRIBUTION.

Box Elder (*Acer negundo*). (Forestry Circular 86.)
Green Ash (*Fraxinus lanceolata*). (Forestry Circular 92.)

FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C.

Windbreaks: Their Influence and Value. (Forestry Bulletin 86.) Price, 30 cents.
The Northern Hardwood Forest: Its Composition, Growth, and Management. (Department Bulletin 285.) Price, 20 cents.
How to Cultivate and Care for Forest Plantations on the Semiarid Plains. (Forestry Circular 54.) Price, 5 cents.
How to Transplant Forest Trees. (Forestry Circular 61.) Price, 5 cents.
White Elm (*Ulmus americana*). (Forestry Circular 66.) Price, 5 cents.
Scotch Pine (*Pinus sylvestris*). (Forestry Circular 68.) Price, 5 cents.
Cottonwood (*Populus deltoides*). (Forestry Circular 77.) Price, 5 cents.
White Willow (*Salix alba*). (Forestry Circular 87.) Price, 5 cents.

D. L. A.—6. Issued June 20, 1919

United States Department of Agriculture.

BUREAU OF PLANT INDUSTRY,

Office of Dry-Land Agriculture,

WASHINGTON, D. C.

INSTRUCTIONS FOR THE PLANTING AND CARE OF CONIFER TREES IN COOPERATIVE SHELTER BELTS.

The following instructions are given cooperators for the planting and care of conifer trees. As such trees are very susceptible to injury from drying, these instructions should be followed without change. If the roots become dry, the tree is dead and can not be revived.

THE CONIFER PLANTING PLAN.

The cooperator's conifer planting plan accompanies these instructions and shows the following:

(1) Name and address of the cooperator.
(2) Location of important buildings and the shelter belt already growing.
(3) Location of the conifer planting.
(4) Length and width in feet of the conifer planting.
(5) The number of rows to be planted.
(6) The number and variety of the trees to be planted in each row.
(7) The distance between the rows and the space between the trees in the row.
(8) The total number of trees of each kind that will be shipped.

The width shown on the plan includes 4 feet on the outside of the outer rows to allow for cultivation. Where rows cross at corners, the trees should be checked to allow cultivation each way.

In all plans, north is at the top of the sheet.

CARE OF TREES WHEN RECEIVED.

Trees will be shipped in the spring as soon as weather conditions permit. This will vary from the middle of April to the first of May. On account of the earlier spring in southern South Dakota and Wyoming and western Montana, the first shipments will be made to those sections.

Cooperators will be notified of the shipments, so that they may be ready to get them. Every effort should be made to take the trees from the post office or express office as soon as possible after their arrival.

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When taking the trees home they should be well covered with blankets to protect them from the wind and sun. If they are to be taken a long distance it would be well to pour a little water into the bundle inside the paper wrapping, allowing it to trickle down and moisten the roots and packing. Do not wet the tops. Upon arrival at the farm the bundle should be put in a cool place until the trees can be planted. If it is not possible to plant at once, the trees should be heeled in.

Heeling in.—Dig a trench 8 to 12 inches deep, with one side sloping. This should be in some sheltered location if possible. Open the bundle, keeping the varieties separate, and place the roots in the trench with the trees lying against the sloping side. Cover the roots with moist soil, packing it firmly against them. If the soil is dry it should be moistened. *Do not cover the tops of the conifer trees with soil.*

PLANTING CONIFER TREES.

Remove the trees from the bundle or from the heeling-in bed and place them in a pail with the roots immersed in muddy water.

Locate the rows by stretching a line, and plant the trees in the following manner:

Thrust the spade straight into the ground and pry up the dirt in front of it; then, without lifting the spade out, push it forward and slip the tree in behind it. Be sure that the tree is set slightly lower in the ground than it grew before; in no case should the tree be planted higher. Spread the roots, making sure that none of them are bent upward but are turned down and not broken or doubled. Pull out the spade, taking care not to pull up the roots with it, and allow the loose dirt to fall back. Tramp the soil as firmly as possible, leaving loose dirt over the tramped surface when finished.

IMPORTANT POINTS.

(1) Keep the roots of the conifers *continually* moist. Even a few minutes' exposure to the sun and wind will be sufficient to kill young trees.

(2) Never manure the ground for conifers nor place manure or stones around the roots when planting. Manure burns the roots, and rocks and stones allow the air to reach the roots, thereby killing the trees.

(3) If, after planting, a shingle can be placed on the south side of each plant to shade it from the sun, better success will result.

(4) Be careful to set the tree deep enough and to pack the soil firmly around the roots.

(5) Young conifers will not succeed in alkaline soil.

(6) Remember that, from the time of unpacking until the trees are in the ground the roots must be kept moist and the plants shaded from the sun as much as possible.

(7) Plant if possible on a cool, cloudy, or drizzly day; but if planting must be made on a clear, warm, and windy day be sure to take the utmost care to keep the roots moist.

CARE AND CULTIVATION AFTER PLANTING.

It is especially important that these instructions in regard to the care of the conifers after planting be carefully read and followed.

The trees should be cultivated immediately after they have been planted or as soon thereafter as possible. Do not wait for the weeds to appear, but keep the ground clean from the beginning. Cultivation alone will not be sufficient to keep out all grass and other weeds. It will be necessary to go through the planting with the hoe and also to pull the weeds around the trees in the row. In hoeing be careful not to scar the bark of the young trees. After each cultivation go over the planting and remove any soil or clods that have been thrown on the trees by the cultivator.

It is just as important to keep the ground in good condition and free from weeds in the conifer planting as in the older hardwood shelter belt. The wider the cultivated strip between the outer row and the sod the better the trees in that row will grow.

Conifers must be given the same good care and cultivation as broad-leaf trees to insure success. Cultivation, except for hoeing and the hand pulling of the weeds about the trees, should cease some time in August. Large weeds should not be allowed to remain in the shelter belt to "catch the snow." They deprive the soil of moisture in the late fall and serve no purpose except to seed the ground, which will cause more work the following spring. The trees themselves will catch the snow.

It is not necessary to mulch the conifer trees; in fact, mulch material is apt to have manure in it or to become heated, which will kill the trees.

Conifer trees must not be pruned except to cut away dead wood, The heavy growth is naturally at the bottom, but if pruned new branches are not readily formed. The heavy bottom growth shades the ground, thus aiding in retaining the moisture and in keeping the ground about the trees free from weeds.

Wherever fire guards or fences are necessary they must be provided. Planting stock will not be sent out to be destroyed by live stock through the carelessness of cooperators.

Approved:

WM. A. TAYLOR,
Chief of Bureau.

MAY 13, 1919.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1919

[This leaflet is sent out only in connection with the distribution of the trees and small fruits to which it relates.]

D. L. A.—7. Issued February, 1925

United States Department of Agriculture

BUREAU OF PLANT INDUSTRY

Office of Dry-Land Agriculture Investigations

WASHINGTON, D. C.

INSTRUCTIONS TO COOPERATORS FOR THE PLANTING OF FRUIT TREES AND SMALL FRUITS ON THE NORTHERN GREAT PLAINS

The following instructions are given cooperators for the planting of fruit trees and small fruits and caring for them during the first season. As it is only with the utmost care that fruit can be grown successfully on the northern Great Plains, these instructions should be followed carefully.

CARE OF STOCK WHEN RECEIVED

Planting material will be shipped in the spring as soon as weather conditions permit. Cooperators will be notified of the shipments. Every effort should be made to take them from the express office as soon as possible after their arrival.

When taking the bundles home they should be well covered with blankets to protect them from the wind and sun. On arriving at the farm they should be opened in a barn or shed and the roots well moistened. If the weather permits, planting should be done immediately. If it is not possible to plant at once, the trees should be "heeled in."

"*Heeling in.*"—Dig a trench 8 or 12 inches deep with one side sloping, and preferably in some sheltered location. Open the bundles, keeping each variety separate, and place the roots in the trench, with the tops lying against the sloping side. Cover the roots well with moist soil, packing it firmly against them. If the soil is dry it should be moistened. It is not necessary to cover the tops entirely.

SPACING

Do not plant fruit trees less than 30 feet from the adjoining rows of an established shelter belt. Apple and crab trees should be spaced from 20 to 25 feet apart and plum trees about 15 feet. Juneberries, sand cherries, and grapes may be planted from 6 to 8 feet apart in rows 10 feet apart. Small fruits should be spaced about 4 feet apart in rows from 8 to 10 feet apart.

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PLANTING

Dig holes wide and deep enough to admit the roots without crowding or bending. Plant trees several inches deeper than they stood in the nursery.

Pack the moist soil carefully and firmly around the roots. Do not fill the soil in loosely and pack only the top, but pack the soil firmly as it is thrown in. One man should throw in the soil while another holds the plant and packs the soil around the roots with his hands and feet. Care should be taken not to break the roots.

Unless the soil is amply moist, dig a trench around each tree or bush and apply a pail of water soon after planting. After the water has soaked into the soil, fill the trench with loose dirt.

PRUNING

Prune trees back to 2 or 3 feet in height soon after planting. Develop a low-headed tree. The lowest branch should be not more than a foot from the ground and preferably on the southwest side of the tree.

CULTIVATION

Keep the land cultivated and free from weeds at all times. Be careful not to injure trees when cultivating, as broken bark may cause the death of the tree. Hand hoeing will be necessary.

PLANTING PLAN

Make a planting plan of the fruit garden, so there will be no difficulty in locating the different varieties. Keep a copy of this plan for your own use and give one to the representative of the United States Department of Agriculture when he visits your place during the summer. Leave the tags on the trees until after this visit.

FEBRUARY 6, 1925.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1925

D. L. A.—8 Issued April, 1925

United States Department of Agriculture
BUREAU OF PLANT INDUSTRY
Office of Dry-Land Agriculture Investigations
WASHINGTON, D. C.

CARE OF FRUIT TREES AND SMALL FRUITS ON THE NORTHERN GREAT PLAINS

DIRECTIONS FOR HORTICULTURAL COOPERATORS

INTRODUCTION

Much care and attention are necessary to grow fruit successfully in any region, and they are especially important on the northern Great Plains, where climatic factors tend to make this branch of horticulture unusually difficult. Therefore, it is hoped that horticultural cooperators will carefully read and follow the suggestions made in this circular.

CULTIVATION

Weeds and grasses should not be allowed to grow in a fruit garden at any time of the year. Cultivation should start in early spring and be frequent enough to destroy weeds before they make any considerable growth. It will be necessary to follow the cultivator with a hoe in order to remove weeds close to the trees.

Be careful that the trees are not bruised or broken by horses or implements when cultivating. Such wounds do not readily heal and may cause the death of the trees. If wounds are made, the edges should be trimmed smooth and the wounds wrapped with cloth or painted with white-lead paint to prevent excessive drying out.

INTERCROPPING

The growth of crops of any kind between the rows of fruit trees is not generally advised, as they compete with the trees for moisture. However, if wide spacing is used (rows 25 feet or more apart) a few rows of some cultivated or garden crop may be grown between the rows of fruit trees during the first few years. Such crops should be 6 feet or more from the young trees.

MANURING

Clean cultivation tends to deplete the humus supply of the soil, so it is desirable to apply an occasional light dressing of stable manure. This is of special benefit on both light sandy and heavy clay soils.

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IRRIGATION

While desirable for such small fruits as strawberries and raspberries, irrigation is not necessary for the home orchard if the trees are otherwise properly cared for.

If irrigation water is available it may be applied several weeks before ripening, to size up the fruit, or at any time when the trees are suffering from drought. A late-fall irrigation, just before the ground freezes, is thought to be of value after a dry summer and fall in reducing winter injury during the following winter. It is better to give one thorough irrigation than several light ones.

A windmill or small gasoline engine and pump will often furnish sufficient water for the home fruit and vegetable garden. Water that is strongly alkaline should not be used.

PRUNING FRUIT TREES

Fruit trees should receive a light but regular annual pruning. This pruning should be done just before growth starts in the spring, except when considerable winter injury is apparent. In such cases it is best to wait until growth starts, so that all dead branches may be removed.

The main objects of pruning in the first few years are to develop a low-headed bushy type of tree and to select strong framework branches. The newly planted tree should be cut back to 20 or 30 inches in height, and, if branched, about five well-placed branches should be selected to form the future framework of the tree. These branches should be cut back to within 8 or 10 inches from the trunk and the other branches removed. If the newly planted tree is not branched the main branches should be selected the following spring.

Suggestions for selecting the future scaffold limbs follow:

(1) Not less than three nor more than six main branches should be chosen.
(2) The lowest branch should be not more than 6 or 8 inches from the surface of the ground and preferably on the southwest side of the tree.
(3) Scaffold limbs should be spaced several inches apart vertically on the main stem or trunk of the tree.
(4) Scaffold limbs should extend in different directions from the trunk, so as to form a symmetrical tree.
(5) Scaffold limbs should form wide angles with the trunk, to minimize the danger of splitting in later years.

After the framework is formed the annual pruning will consist largely in removing one of two limbs that rub each other, one of two limbs forming a sharp angle that is liable to split, dead or broken branches, and sprouts from the root. When the growth in the top of the tree is too thick thinning should be done to admit light to the larger branches and encourage the growth of fruiting spurs on them. This thinning should not be too severe, or sun scald of the larger branches may result.

Branches should always be cut off close to a larger limb or close to the trunk of the tree, as stubs do not readily heal over and rot infections may gain entrance through them.

Pruning wounds over an inch in diameter should be painted with fairly thick white-lead paint to protect the wound until it is healed over.

Pruning tools should be kept sharp and in good condition, as a clean close cut is desired. One-hand shears for small branches and

long-handled pruning shears for larger limbs will be needed. A pruning saw will be useful on trees that have been neglected.

PRUNING SMALL FRUITS

Raspberry canes that bore fruit may be removed as soon as the crop is harvested, as they will not fruit again. Five or six of the best new canes are left to each hill.

Currants are pruned by cutting out some of the old wood each year, leaving a few of the most vigorous new canes to replace the older ones. A good plan is to leave three 3-year-old shoots, three 2-year-old shoots, and three 1-year-old shoots at the time of the annual pruning. Thus, pruning will consist of removing three 4-year-old canes and the surplus 1-year-old shoots, while three of the most vigorous 1-year-old canes are left for future fruiting.

Gooseberries are pruned by cutting out some of the weaker older wood that has borne fruit for a number of years and selecting vigorous new wood to replace it.

THINNING FRUIT

Trees should not be allowed to overbear, as the fruit will be small and of poor grade. Large limbs may be broken by the weight of the crop, and the tree may be so weakened that it will be very susceptible to winter injury. Plums should be thinned before the pits harden and apples and crabs after the so-called "June drop." Thinning does little good if delayed until the fruit is more mature. Small fruits are seldom thinned.

The extent of thinning will depend on the size of the variety when ripe and the strength of the branch. Thus, Compass cherries may be left much closer together than large plums, and crabs closer together than apples. Fruit on weak branches that are liable to break should be thinned more severely than fruit on strong branches.

SPRAYING

Every grower should spray his fruit trees, especially after they reach a bearing age. A common barrel-pump sprayer of about 50 gallons capacity is convenient for the home orchard.

Three annual applications of spray ordinarily are advised, the first just before the flower buds open, the second just after the petals fall, and the third about three or four weeks after the second.

The spray commonly used for fruit trees at the Northern Great Plains Field Station consists of—

Arsenate of lead (powder)	½ pound.
Lime-sulphur concentrate	2⅓ quarts.
Nicotine sulphate (40 per cent)	3 ounces.
Water	20 gallons.

If aphids, or plant-lice, are not troublesome the nicotine sulphate may be omitted.

PROTECTION FROM RABBITS

If possible, put a rabbit-proof fence around the fruit garden, as rabbits have killed many of the fruit trees planted on the northern

Plains. If such a fence is not provided the trunk and larger branches of each tree should be protected with wood veneer wrappers, heavy paper, burlap, fine woven wire, or cornstalks. These materials are put around the trees in the fall, before heavy snows, and are not removed until grass or other green material is available to the rabbits in the spring.

Sometimes fresh blood, liver, lime-sulphur mixed at the rate of 1 gallon to 10 gallons of water, or some other repellent is applied to the trunks and larger branches of the tree to keep rabbits from eating the bark. The addition of a pound of glue to the lime-sulphur solution adds somewhat to its durability.

Shooting and poisoning are also resorted to. Poisoned grain or alfalfa leaves have been employed with fair success.

The following directions for preparing poisoned alfalfa leaves and poisoned oats are given by the Bureau of Biological Survey, United States Department of Agriculture:

Poisoned alfalfa leaves.—Dissolve 1 ounce of strychnine sulphate in 2 gallons of hot water and sprinkle over 10 pounds of alfalfa-hay leaves. Mix the leaves thoroughly until all moisture is absorbed.

Poisoned oats.—Mix 1 tablespoonful of starch in half a cup of cold water and stir into 1 pint of boiling water to make a thin, clear paste. Mix 1 ounce of powdered strychnine with 1 ounce of powdered bicarbonate of soda (baking soda) and stir with the starch to a smooth, creamy mass. Stir in 1 teacup of table salt. Apply to 12 quarts of good, clean oats and mix thoroughly so as to coat each kernel.

Corn has been used instead of oats at the Northern Great Plains Field Station and seems to be eaten more freely by the rabbits.

SPECIAL WINTER PROTECTION

Raspberries and grapes should be covered with soil during the winter. Cutting the roots on one side with a spade will facilitate bending the canes without breaking them. The plants should be covered before the ground freezes in the fall and uncovered before the canes start growth in the spring.

Strawberries should be protected by covering them with about 6 inches of clean straw after the ground freezes in late fall or early winter.

The roots of young trees should be protected by piling soil, old manure, or straw around the trunks. Soil is applied before the ground freezes and is leveled off in early spring. If old manure or straw is used it should be applied very late in the fall or early in the winter, as mice are then not as liable to get in it and girdle the trees. If mice do get in, the straw must be removed and the mice killed or fine woven-wire protectors provided for the trees.

It pays to give young trees every possible protection, as they are more likely to winterkill than older, better-established ones.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1925

[This leaflet is sent out only in connection with the distribution of trees for shelter-belt demonstrations]

D. L. A.—9 Issued March, 1926

United States Department of Agriculture

BUREAU OF PLANT INDUSTRY

Office of Dry-Land Agriculture Investigations

WASHINGTON, D. C.

SHELTER-BELT LOCATION AND PREPARATION OF LAND FOR TREE PLANTING

The following instructions are given cooperators for planning the location, size, and shape of a shelter belt and for preparing the land for tree planting.

LOCATION OF THE SHELTER BELT

The proper location of the shelter belt will depend upon whether the protection is for buildings and yards or for an orchard or garden.

BUILDINGS AND YARDS

Winter protection is the important consideration in laying out a shelter belt for building and yards. Winter storms on the northern Great Plains usually come from a northwesterly direction, and the shelter belt should be placed on the north and west sides of the buildings and yards, usually in the shape of a strip or belt of uniform width in the form of a right angle.

A wide belt is much more "wind tight" than a narrow belt. For this reason a shelter belt should not be less than 50 feet wide and may be at least 100 feet or more if available land will permit.

Snow drifts very commonly pile up beyond the inside edge of a narrow planting of trees, but in wide plantings the tendency is for the snow to settle among the trees. A snow trap is an excellent arrangement for preventing snow from piling up in the yards and doorways and for reducing the damage done by deep snow in breaking the branches of young trees. It is provided by arranging the shelter belt in two parallel strips with an open space or snow trap between. On the outside or side toward the wind a narrow belt of trees 20 to 30 feet wide is planted, next comes an open space 30 to 50 feet wide, and then a wider belt of trees 50 to 100 feet wide.

The inside edge of a shelter belt should be at a distance of 100 to 150 feet from the principal buildings.

ORCHARDS AND GARDENS

Spring and summer protection is the important consideration in planning shelter for a garden or orchard. Shelter on the west and

south is of most importance. Protection on the north is desirable and also to a somewhat less degree on the east. The best protection for orchards and gardens is afforded when shelter is provided on all sides.

The roots of trees will extend for some distance in cultivated soil, so that a space of about 20 feet in width on the inside of a shelter-belt planting will not be suitable for fruit trees or garden crops, but should be considered as a part of the ground occupied by the shelter belt.

PREPARATION OF THE LAND

When trees are transplanted they must adapt their root systems to the new soil before they can send out leaves. The initial root growth is difficult and often impossible in a soil that is dry or that contains a large amount of rough sod or coarse stubble. Under dry-farming conditions, trees have a fair chance for success only when planted in moist soil that is free from sod and weeds. A supply of moisture in the soil at the time of planting is of utmost importance to success.

In areas of limited rainfall, clean summer fallow during the year before the trees are planted is the best tillage method for preparing land for trees. Summer fallow, if properly handled, will store needed moisture in the soil and at the same time effectively kill out grass and weeeds.

GENERAL RULES FOR SUMMER FALLOW

(1) Plow in the spring before the 1st of June. The most favorable time is usually during the last two weeks in May. Plowing should be to a depth of from 6 to 8 inches. As soon as plowing is completed go over the ground once or twice with a harrow.

(2) Cultivate during the entire growing season as often as necessary to keep the land free from weeds. It is also advisable to cultivate whenever the surface soil has become packed by unusually heavy rainfall.

(3) Use a shovel or duck-foot type cultivator for working the land during the summer, if available. This type of implement puts the surface in a better condition for soaking up rainfall than either the disk or harrow.

(4) Give the land one cultivation late in the fall to destroy late weeds and to put the surface in a rough or ridged condition for winter.

(5) Do not plow the ground again, as a firm well-settled soil is best for planting trees.

OBJECT OF SUMMER FALLOW

The object of summer cultivation of fallow is not only to kill weeds but also to keep the surface in a favorable condition for the absorption of rainfall. A surface that is rough or ridged is more readily penetrated by water than one that has been worked down into a fine, smooth, dustlike condition.

New land or land that is in sod or grass may require two years of cultivation to put it in proper condition for planting trees. There

are many cases, however, where the desired condition may be obtained in one year, provided enough work is done. If the sod has not been thoroughly worked down by the end of the first season, it is better to summer-fallow for another year than to plant the trees before it has been completely subdued.

FENCING

Before trees are planted a fence that will keep out all classes of livestock should be provided. Rabbit-proof woven wire makes the best type of fence for this purpose.

Approved:

WM. A. TAYLOR,
Chief of Bureau.

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